

The Epidemiology of Lung Cancer

Recent Trends

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A retrospective epidemiologic investigation of 350 lung cancer patients confirmed the close association between cigarette smoking and lung cancer, particularly of the squamous and oat cell types. New trends in this study how that there is a decrease in relative risk for those patients developing lung cancer ten years after they have switched to filter cigarettes, possibly due to the lower tar content in filter cigarettes smoked by these patients. The risk also declines after complete cessation of smoking and appears to approach the level of nonsmokers after 13 years of not smoking. Further efforts to produce less harmful tobacco products should be continued and expanded although no smoking or cessation of smoking is the most effective prevention against lung cancer.

With a wealth of epidemiologic studies on the etiology of lung cancer in the literature, it may not seem worth the effort to report yet again on the environmental background of a group of lung cancer patients.¹⁻⁴ However, such a study is of value if it can show evidence of changes, particularly in the trends, in the epidemiological background of these patients.

In a great many epidemiologic studies, it has been found that, among cigarette smokers, the risk of lung cancer increases with the number of cigarettes smoked per day.¹⁻⁴ In other words, there is a dose-response relationship. This suggests that reducing dosage by means of reducing the concentration of the smoke from each cigarette might have the same effect as reducing the

number of cigarettes smoked per day. If "tar" is the principal harmful ingredient, then it would be sufficient to reduce the concentration of the tar.

The Hammond study on ex-smokers aged 50 to 69 years who had smoked 20 or more cigarettes daily, shows that after ten years of not smoking they have a death rate similar to that of nonsmokers.⁵

These two pieces of evidence taken together suggest the following hypothesis:

If tar is the principal lung cancer inducing factor then people who have switched from high tar cigarettes to low tar cigarettes should have lower rates of lung cancer than those who continue to smoke high tar cigarettes—this taking place ten or more years after the switch.

The present study was undertaken to test this hypothesis.

Methods of Study

Lung cancer patients admitted to the Memorial Sloan-Kettering Cancer Center in New York City are interviewed routinely about their background and social habits.

Each patient included in this report has a histologically-proven lung cancer and was interviewed between November 1966 and August 1969. The study group consisted of 210 men and 30 women with Kreyberg

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co could not be carried out because of the paucity of cases after such cross-tabulation.

A review of the environmental history of lung cancer patients who were long-term exsmokers might be of interest in view of determining probable exogenous factors that might be related to the etiology of the cancer. The study contained six lung cancer patients who had given up smoking at least ten years prior to diagnosis. Of these six cases, the only one to have smoked for less than 22 years had a most unusual epidemiological history which suggested his lung cancer could have been related to factors other than smoking. Between the ages of eight and ten years, the patient was treated for psoriasis with potassium arsenite. At 27 years of age, he had a lymph node tumor removed from his groin and received x-ray therapy. At the age of 37 years the patient had an epidermoid carcinoma of the scrotum as well as a squamous cancer of the buttock. The present cancer of the lung was diagnosed the following year and seven months later yet another primary, this time adenocarcinoma of the kidney, was detected. There is a possibility that these multiple primaries, particularly of the skin surface, may be associated with high doses of potassium arsenite⁷ and that the effect of this medication is also related to the lung cancer. Of interest in this respect is the report by Robson and Jelliffe of six patients who developed lung cancer after the therapeutic administration of arsenic.⁸ Cahan made a similar observation and suggested a possible synergistic action of the arsenical compound and cigarette smoke. (oral communication from Dr. William Cahan, Aug 18, 1969) A metastatic spread of the scrotal lesion to the lung, although a rare occurrence, is also a possibility.

One exsmoking patient had given up 18 years previously after smoking heavily for 22 years. Another patient who had given up smoking 20 years

previously was a carpenter by trade, an occupation often associated with lung cancer in nonsmokers.¹⁰

Nonsmokers With Lung Cancer: The fact that Kreyberg 1 lung cancer can develop in a nonsmoker, though it is quite rare, needs to be considered. One of the three nonsmokers in the male Kreyberg 1 group was a house painter. Like a carpenter, this is an occupation more common than could be expected among smokers with epidermoid carcinoma of the lung.¹⁰ The second nonsmoker was a 54-year-old physician who received excessive nitrogen and sulfur mustard gas exposures while working in the Chemical Warfare Service in 1942-1946. Really adequate protective clothing and gas masks were not considered very important in those days and on many occasions he suffered blisters and burns on the skin after visiting fields where these gases had been used. The increased occurrence of lung cancer among poison gas workers in Japan is of interest in respect to this case.¹¹ The third nonsmoker with epidermoid lung cancer was an archaeologist.

Comment

The findings of the present study in respect to filter cigarettes are consistent with the hypothesis presented in the beginning of the communication.

Figure 4 shows the decline in tar content in leading filter and nonfilter brands of cigarettes since 1958 as well as the increased share of the market taken by filters in this period. These are interesting observations since at the beginning of the 1950's, filter cigarettes represented only a very small fraction of the total consumed in the United States.

Conceptually, lung cancer develops when the cumulative tar dose has reached a certain level. If the dose in a single cigarette is reduced by 20% it would be reasonable to assume that to achieve the critical dose level, the individual would have

to smoke more cigarettes.

The Hammond study on exsmokers aged 50-69 years who had smoked 20 or more cigarettes daily, shows that after ten years of not smoking, the individuals have a death rate from lung cancer similar to that of nonsmokers.² After five to nine years, when Hammond's study shows a decline of 50% among exsmokers, a similar change as found for filter smokers in the present study, can be expected if smokers change to a lower tar cigarette. On the basis of Hammond's study and our hypothesis, no change would be expected among heavy smokers aged 50-69 years who shifted to filter cigarettes and smoked them for five years or less. The Hammond study showed also that exsmokers who had been light smokers (1-19 cigarettes per day) already had a reduced lung cancer risk one to four years after stopping relative to those who had continued smoking. Similar findings were observed by Doll and Hill.¹² The present study did not contain sufficient exsmokers to carry out a separate analysis of those who had smoked less than 20 cigarettes per day and who were under 50 years of age.

As none of the lung cancer patients in the present study started out smoking filter cigarettes, the relative risk for individuals who smoked only filter cigarettes could not be determined.

From an experimental point of view, few of the longterm filter smokers in the study used filters that would have selectively removed components toxic to the cilia from the gas phase, such as hydrogen cyanide and volatile aldehydes. Cellulose acetate fibers, from which the vast majority of filters are made, tend to remove selectively some acidic components from smoke. Since available filter materials generally do not selectively remove carcinogenic agents from the particulate matter and the tar from filter cigarettes has the same tumorigenic

considered. It is well known that cigarette smokers have an increased mortality and morbidity rate for myocardial infarction especially among men under the age of 50 years.¹¹ In the final analysis, the judgement of whether one cigarette is less harmful to man than another cigarette can only be made by measuring its long-term effect on man himself.

Preventive Considerations.—Clearly, the most successful way to reduce the risk of lung cancer is not to smoke cigarettes in the first place or to give up smoking as early in life as possible.

While individual motivation to cease smoking can and has accomplished much, the great number of Americans who still smoke cigarettes suggests that the large-scale educational efforts against smoking are not likely to be entirely effective. For this reason, we must implement deliberate managerial measures of the type classically so successful in solving public health problems in the past to do their share in reducing the risk of lung cancer and other tobacco-related diseases. While individual motivation should be encouraged more than ever, managerial preventive measures affecting the entire population of smokers must be expanded. The undertaking of effective prevention in this area is the responsibility of all—the government, the tobacco industry, the health professions, and the general public. With the burden to effect change placed on the shoulders of society as a whole, it is society that will reap the harvest of its actions in years to come.

Conclusions

This study was based on 350 lung cancer patients seen at the Memorial Sloan-Kettering Cancer Center between November 1966 and August 1969.

As in previous studies, cigarette smoking is strongly associated with cancer of the lung. This association

is greater for the squamous and oat cell types than for the glandular type even though the latter is also related to cigarette smoking.

A lower relative risk of lung cancer (Kreyberg I group) was found for individuals who had smoked filter cigarettes for at least ten years after switching from nonfilter cigarettes than for those who continued to smoke nonfilter cigarettes. Since filter cigarettes tend to be lower in tar than nonfilter cigarettes, the results suggest that a reduction in tar yield of a given strength will be associated with a decreased risk for lung cancer unless the smoker compensates for the lower tar dosage by smoking more cigarettes.¹⁴

The lung cancer risk for individuals who smoked only filter cigarettes cannot be determined at this time.

The relative risk for lung cancer among exsmokers continues to be high for at least three years after cessation of smoking. Thirteen years after an individual has stopped smoking the relative risk appears to be close to that of individuals who never smoked.

Further efforts to produce less harmful tobacco products should be continued and expanded although not smoking or cessation of smoking is the most effective prevention against lung cancer.

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